DOCUMENT RESUME

ED 349 162 SE 052 907

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TITLE Hidden Treasures for Science Teaching: United States Patents.
PUB DATE 92
NOTE 16p.; Figures 1 and 2 on pages 7 and 10 may not reproduce well.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Elementary Secondary Education; *Inventions; *Patents; *Science and Society; Science Education; Science Education History; *Science History; *Science Instruction

ABSTRACT

United States patents are a source of historical information with many implications for science teaching. Using patents as science teaching devices has been largely ignored by science educators. Some of these devices can be easily modified for use in today's classrooms; in addition, patents serve as great examples of how our knowledge of science has increased at an ever increasing rate. Patents also provide interesting illustrations of the interaction of science, technology, and society. In the area of history of science and science teaching, patent records represent a valuable source of information. This document presents information about the United States patent process, doing a patent search, examining patent announcements and patents, and using patents in science teaching. This paper presents a table of famous patents including those of Morse, Goodyear, Gatling, Westinghouse, Pasteur, Edison, Eastman, Diesel, Ford, and Houdini. (PR)

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HIDDEN TREASURES FOR SCIENCE TEACHING:

UNITED STATES PATENTS

by

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HIDDEN TREASURES FOR SCIENCE TEACHING:
UNITED STATES PATENTS

Each month dozens of demonstrations and laboratory activities are described in professional journals and newsletters for science teachers. Although the number of these journals and newsletters is at a all time high, the publication of innovative approaches and devices for presenting science concepts is nothing new. Nineteenth century journals, such as Scientific American and the Scientific American Supplement, regularly described science demonstrations or "parlor tricks," many using common objects found in most households. United States patents are another source of historical information, with many implications for science teaching.

Patents for science teaching devices have been largely ignored by science educators. Some of these devices can be easily modified for use in today's classrooms; in addition, patents serve as great examples of how our knowledge of science has increased at an ever increasing rate. Patents also provided interesting illustrations of the interaction of science, technology and society. And for those interested in the history of science and science teaching, patent records represent a gold mine of information.

United States Patents and Their Classification

A patent protects the property rights of the inventor for 17 years and is intended to encourage the creative efforts of scientists, engineers and others. The United States Government started issuing patents in 1790; the patent law was revised in 1836 and since that time United States Patents have been numbered consecutively. The total number issued since 1836 recently passed five million, with the last two million having been granted in the past 30 some years. What better

example of the knowledge explosion in science?

Most of the approximately five million patents issued thus far deal with non-living objects and processes. Although it always has been possible to obtain a process patent involving plants (such as a method for retarding the bloom of fruit trees), it was not until about sixty years ago that a plant itself could be patented. Under the Plant Patent Act of 1930, an applicant can obtain a patent by convincing the United States Patent Office and Trademark Office (hereafter referred to simply as the Patent Office) that his or her plant is a "new and distinct variety." Plant Patent Number 1 was granted on August 18, 1931 to Henry F. Bosenberg for a rose appropriately called "The New Dawn." With advances in biotechnology, it is expected that the number of plant patents issued in the future will increase dramatically.

The Patent Office classifies each patent according to class and subclass, which does not differ much from the way the librarians classify books or scientists classify various organisms and objects. The hierarchical structure for classifying patents is described in the Patent Office's Manual of Classification. Most devices for teaching science are placed in Class 434 (Education and Demonstration), subclasses 276--303. The titles of these subclasses, taken from the Manual of Classification, are shown in Table 1. The number of patents in each subclass as of November 1, 1989 has been added by the author to illustrate the approximate size of these subclasses.

Doing A Patent Search

Perhaps the easiest way to explain the steps in doing a patent search is by using an example. Let's say that you are interested in patents dealing with devices for teaching astronomy. In Table 1 your can seen that subclasses 284-294 all deal with some aspect of the topic. Subclass 284 cover the general topic of astronomy and is a subdivision of Class 276, which includes science teaching devices in general. As a way of getting started, let 's concentrate on the patents for devices

Table 1

Selected Subclasses in Class 434: Education and Demonstration

276	SCIENCE [16]*
277	. Crystal structure model or display having discrete element (e.g., geometric shape, light, etc.) representing atom [10]
278	. Molecular model or display having discrete element representing atom or radical [60]
279	. . Model having helical chain of elements (e. g., DNA model, etc.) [9]
280	. . Atom or radical represented by element formed of sheet material [14]
281	. Model or display demonstrating structure or property of atom or radical [23]
282	. . Indicis chart (e. g., periodic table, etc.) [18]
283	. Means demonstrating physical property (e. g., osmotic pressure, solubility, etc.) of substances [13]
284	. Astronomy [32]
285	. . Representation of light generating celestial body [36]
286	. . . Light spot [70]
287	. . . Celestial globe [24]
288	. . . . And earth representation [23]
289	. . . Finding or identifying aid [42]
290	. . . Simulation of sun and earth [65]
291	. . . . Simulation of motion of earth and another major planet around sun [64]
292	. . . . And moon [38]
293	. . . . . Moon model moved around earth model by mechanical or electrical means [62]
294	. . . . . By belt drive [17]
295	. Biology or taxidermy [28]
296	. . Specimen display [68]
297	. . . Specimen enclosure [35]
298	. Chemistry or metallurgy [27]
299	. Geology [22]
300	. Physics [40]
301	. . Electricity or magnetism [59]
302	. . Statics or dynamics [75]
303	. . Optics [31]

*The number of patents in each subclass, which has been added by the author, is not shown in the Manual of Classification since this number changes as new patents are granted or older patents are reclassified (As of November 1, 1989).

for teaching about the moon. From Table 1, we can see that Subclasses 292-294 contain patents relating to the moon. Let's start with Subclass 292. Just as in the case of library indexes used to classify books, the four dots in front of the title of Subclass 292 indicates that it is a subdivision of Subclass 290, which only has three dots in front of its title.

How does one go about determining which patents are included in Subclass 292? Although there are printed indexes that could be used, this is not the easiest way to search the patents in a subclass. A list of the number of all patents in Subclass 292 can be obtained using CASSIS, the Classification and Search Support Information System of the Patent Office. And the good news is that you don't have to go to Washington, DC to use this computerized search system. The bad news is that many libraries do not have access to this search system and the patents records that are needed in the next step. However, there is a network of depositories spread across the United States that do have access to CASSIS and patent documents in printed and/or microfilm versions. A list of these depositories can be obtained by writing the Commissioner of Patents and Trademarks, Washington, DC 20231.

It is always a good idea to call ahead the first time you plan to visit a depository to determine the hours they are open, the kinds of resources they have and the nature of the help they can give visitors. For example, CASSIS has recently been made available in a CD-ROM format and you may be expected to enter your own searches. You should not let this be a deterrent because the depositories all have a specially trained staff to help you get started and the system is easy use.

Table 2 is a list of some of the patents in Class 434, Subclass 292 obtained using CASSIS at a Patent Depository. Before you begin looking at the individual patents on the list in Table 2, a few things should be noted about the information on the printout in addition to the patent numbers:

Table 2

Prinout of the First Ten and Last Ten Patents in Class 434, Subclass 292

Classification Mode--434/292

Number of Patents: 38

1. 4,747,780 XR - MULTI-FUNCTION GLOBE WITH ITS RELATED PLANETS
2 4,713,011 OR - SOLAR SYSTEM SIMULATOR
3. 3,750,308 OR - EDUCATIONAL DEMONSTRATION MODEL
4. 3,339,297 XR - [Paramagnetic Boards and Attachment]*
5. 2.797,500 OR - [Educational Devices]
6. 1,484,174 OR - [Device for Indicating the Relative Movements of the Earth, Sun, and Moon]
7. 1,271,104 OR- [Tellurian]
8. 1,261,809 OR- [Tellurian]
9. 1,195,420 OR- [Model of the Solar System]
10. 1,135,204 OR- [Telluraian]

. . . . . .

29. 390,335 OR- [Tellurian]
30. 362,871 OR- [Tellurian]
31. 327,631 OR- [Device for Representing the Motions of the Earth and Moon]
32. 320,999 XR- [Terrestro-Sidereal Sphere]
33. 317,307 OR- [Tellurian-Globe]
34. 254,229 OR- [Educational Globe]
35. 249,739 OR- [Tellurian]
36. 202,590 OR- [Tellurians]
37. 60,642 OR- [Terrasphere]
38. D114,648 XR- [Design for a Tellurian]

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*Titles enclosed in brackets were added by the author and are not part of the CASSIS printout for Class 434, Subclass 292.

1. Note that the patents are listed from the most recent (largest number) to the earliest (smallest number).
2. Each number is followed by the symbols OR, XR, or UR. Patents for which Class 292 is currently designated as the original classification are followed by OR. Patents in another subclass that are someway related to Subclass 292 are designated as XR (cross-reference) or UR (unofficially cross-referenced).
3. The printout of patents in a subclass gives the titles of most patents from 1969 to the present; however, the titles for older patents are not in CASSIS. Also the titles for recently issued patents may not be available in CASSIS. In Table 2, the author has indicated the titles not generated by CASSIS by enclosing them in brackets.
4. A printout may contain numbers preceded by one or more letters. Most of the five million patents granted thus far are classified as utility patents and do not have a letter prefix. A design patent, designated by a "D," is issued to a person who has invented a new, original and ornamental design for an article of manufacture. In the case of Subclass 292 shown in Table 2, the last patent on the list (Number 114,648) is a design patent as indicated by the "D." A reissued patent, designated by a "RE," is issued as a correction to patent which is partly or wholly inoperative due to error which was made without deceptive intent.

If you are able to visit the Patent Office in Crystal City, Virginia, across the Potomac from Washington, DC., you will be able to examine copies of the patents, which are shelved by subclass. If you must work at a depository as I do, there are two ways to proceed. You can chose to examine the patent announcements that are published in the Official Gazette of the United States Patent and Trademark Office: Patents and which may be available at a depository in both printed and microfilm version. A sample announcement for Patent Number 320,999 is included as Figure 1. Or you may wish to look at the patents themselves, which at most depositories will mean looking a microfilm. My

Figure 1

Sample Patent Announcement, With First Three Claims

320,999. TERRESTRO-SIDEREAL SPHERE. JOHANNES G. BERNEIKE and M. LOUISE BERNEIKE, Brooklyn, N. Y. Filed Mar. 31, 1884. (No model.)

Claim.—1. The combination, with the globe E, of a pivot corresponding with the prolongation of the polar axis of the globe, and a slotted meridian-bar, G, carrying a figure representing the observer, the slotted meridian-bar being capable of sliding upon the said pivot to allow the figure representing the observer to stand at the pole, as herein specified.

2. The combination, with the horizon-plate H, of the curved bars I J, crossing each other at right angles, the meridian-bar G, and a wire, *g*, extending from the said curved bars to the meridian-bar G, and representing a radius of the earth extended to the observer's zenith.

3. The combination, with the globe E and spindle D, of the sleeve K, and a hollow sphere composed of wires *l l*, *m m*, and *n n*, as described.

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suggestion is you start with the announcements, which usually give enough information for you decide whether or not the device is something you want to study further.

Once you have a list of patents, you can browse in copies of the Official Gazette just as you might do with a collection of books. But doing science is best done systematically and the same applies to patent work. Base on the research done in assembling a compilation of nearly 3,000 patents on amusement rides and devices, I have found the following system works well for me:

1. Once I have the printout of the patents in a subclass, I circle all those with an "OR" classification. I do not worry about checking those with "XR" and "UR" designations because they should show up as "OR" under some other subclass.
2. I copy the patent numbers on slips of paper and keep the slips arranged in numerical order.
3. I prefer using printed copies of announcements and so the next task is to pull the bound volumes of the Official Gazette and locate the announcements. Since photocopying is inexpensive and I don't like to keep going back to the library to check a particular patent, I photocopy most of the patent announcements I check. An alternative is to make notes about each patent on the slips of paper containing the patent numbers.

   If I am going to check the patents in several subclasses, I combine the slips for the various patents so I don't have to keep going back to the same volumes--there are no advantages to doing one subclass at a time if you know you are eventually going to check several subclasses. Bound volumes of the Official Gazette occupy more than 300 linear feet of shelf space, so searching the announcements systematically saves time. Also, since bound volumes of the Official Gazette get heavy, I usually manage to borrow a book cart when I pull these volumes to photocopy the announcements.
4. In case of my collection of announcements of patents on amusement rides or devices, I

have cut out the announcements and cemented them on a 5 x 8 cards. Although time consuming, this has proven to be a wise procedure and makes it easy to check various aspects of a particular patent whenever I need to do so.

Before you cut out the announcements, you should note that the date at the top of the page of the Official Gazette; this is the date the patent was issued. Although the date the patent was filed is on the announcement, the date of issuance is not. So if you are interested in having a record of the date of issuance, this should be noted before the announcement is removed from the photocopy of the page on which it appears.

5. If the patent announcement suggests the device covered by the patent bears closer study, I go to the patent itself. The the drawing which is a part of the Patent Number 327,631 is shown in Figure 2. A patent may contain claims not reported in the announcement and often includes drawings of the device from more than one perspective. The claims covered by the patent often are written in a language that makes it difficult to figure out how the device works; on the other hand, the drawings usually are helpful in this respect. The patents are available on microfilm and/or paper at patent depositories and most have facilities for making hard copies. Or you may wish to order copies of patents from the Patent Office. All you need to do is list the numbers of the patents for which you desire copies and enclosed payment of $1.50 for each patent. The address to which you send you order is: Commissioner of Patents and Trademarks, Washington, DC 20231.

Using Patents In Science Teaching

The use of patents to develop science teaching devices is probably obvious from the examples of patents given thus far. You may want to modify the device to better met you objectives or simplify its construction. Be sure to remember that patented devices are protected for 17 years and

Figure 2

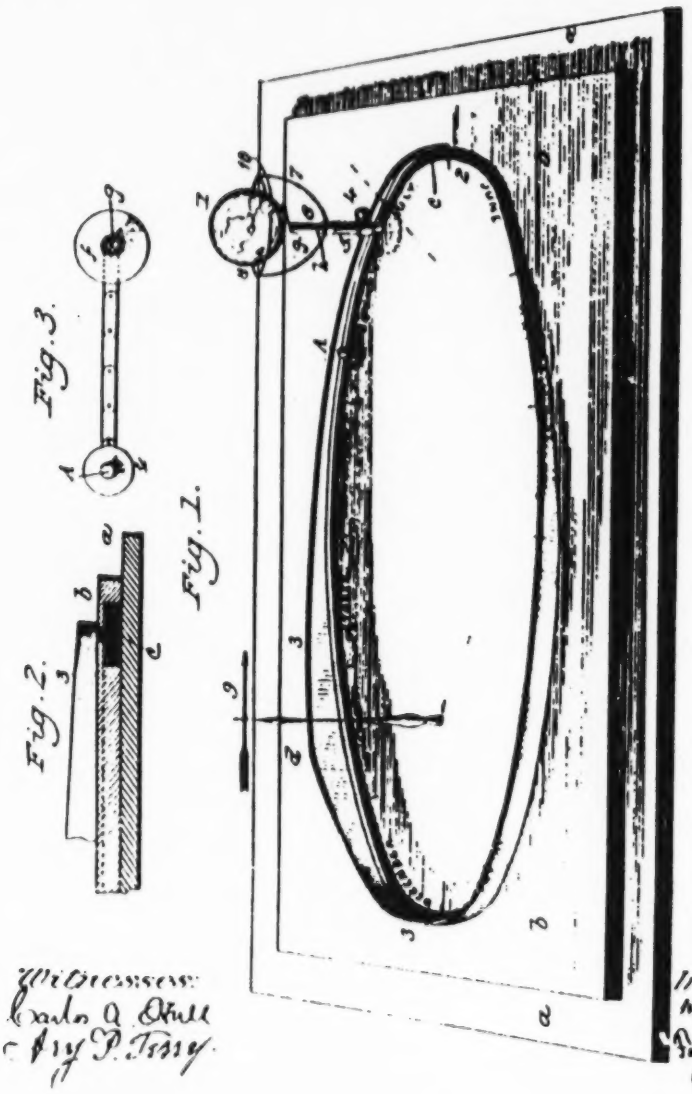
Sample Drawing From A Patent

(No Model.)

W. W. WHITCOMB.

DEVICE FOR REPRESENTING THE MOTIONS OF THE EARTH AND MOON.

No. 327,631. Patented Oct. 6, 1885



care should be taken not to infringe on the patent. Since recent patent announcements contain the addresses of patentees, you may want to write the inventors to see if any devices patented in the last 17 years have been produced commercially and are available for purchase.

Given access to a patent depository, students may find patents a useful tool in doing an historical investigation of some aspect of science or technology. The number of possible topics is almost endless, but certainly would include advances in communication (telegraph, telephone, radio, television, etc.), transportation (trains, street cars, automobiles, airplanes, rockets, etc.) and agriculture (farm machinery, food processing equipment, etc). With a little imagination and some enjoyable hours in a patent depository, such an investigation could easily be an award-winning entry in various science competitions.

Patents also can be used to stimulate creative thinking and teach problem solving skills. To learn more about this use of patents, you may want to obtain copies of publications produced as part of Project XL, an outreach program of the Patent Office.

Interested in using patents, but unable to visit a patent depository? You still may do so by ordering copies of a few patents from the Patent Office. They make an eye-catching bulletin board display or can be used to make overhead transparencies to illustrate some of your presentations. A list of patents that may be of interest is included as Table 3. Did you know which American president received a patent on "buoying vessels over shoals?" Which famous American author patented "adjustable and detachable straps for garments?" When the vacuum cleaner was invented? The ball point pen? The zipper? Our most popular board game, Monopoly? Answers to all these questions are given in Table 3

If you have never had the opportunity to examine patent announcements or the patents themselves, you are in for a treat. And as is the case in doing science, you never will know what you will find until you give it a try. While searching for a patent of a Ferris wheel , I spotted a patent

Table 3

Selected United States Patents of Historical Interest

Number	Year	Inventor	Patent Title
1,647	1840	Morse, Samuel B.	Telegraph signs
3,633	1844	Goodyear, Charles	Improvement in rubber fabrics
4,750	1846	Howe, Elias, Jr.	Improvement in sewing machine
6,281	1849	Hunt, Walter	Dress-pin (safety pin)
6,469	1849	Lincoln, Abraham	Buoying vessels over shoals
16,082	1856	Bessemer, Henry	Improvements in the manufacture of iron and steel
22,186	1858	Mason, John L.	Improvement in screw-neck bottles (Mason jar)
36,836	1862	Gatling, Richard J.	Improvements in revolving battery guns (machine guns)
88,929	1869	Westinghouse, George	Improvements in steam-power-brake devices (air brakes)
91,145	1869	McGaffey, Ives W.	Improved sweeping-machine (vacuum cleaner)
121,992	1871	Clements, Samuel L.	Improvements in adjustable and detachable straps for garments
135,245	1873	Pasteur, Louis	Improvements in brewing beer and ale (pasteurization)
157,124	1874	Glidden, Joseph F.	Improvements in wire fence (barbed wire)
174,465	1876	Bell, A. Graham	Improvements in telegraphy
200,521	1878	Edison, Thomas A.	Improvements in the phonograph or speaking machine
223,898	1880	Edison, Thomas A.	Electric lamp
306,594	1884	Eastman, George	Photographic film (transparent photographic paper strip film)
388,850	1888	Eastman, George	Camera (roll film camera--Kokak)
392,046	1888	Loud, John J.	Pen (ball point pen)
493,426	1893	Edison, Thomas A.	Apparatus for exhibiting photographs of moving objects
504,038	1893	Judson, Whitcom B.	Clasp locker or unlocker for shoes (zipper)
608,845	1898	Diesel, Rudolf R.	Internal combustion engine
621,195	1899	Zeppelin, F. Graf	Navigable balloon
657,711	1900	Stanley, F. E., et al	Motor vehicle (Stanley steamer)
686,046	1901	Ford, Henry	Motor carriage
821,393	1906	Wright, Oville & Wilbur	Flying-machine
1,103,503	1914	Goddard, Robert H.	Rocket apparatus (rocket engine)
1,370,316	1921	Houdini, Henry	Diver's Suit (permitting escape)
1,522,176	1925	Carver, George Washington	Cosmetic and process of producting same
1,773,079	1930	Birdseye, Clarence	Method of preparing food products (packaged frozen foods)
1,948,384	1934	Lawrence, Ernest O.	Method and apparatus for acceleration of ions (cyclotron)
2,026,082	1935	Darrow, Charles B.	Board game apparatus (Monopoly)
2,351,004	1944	Camras, Marvin	Methods and means of magnetic recording (tape recorder)
2,524,035	1950	Bardeen, John & Brattain, Walter H.	Three-Electrode Circuit Element Utilizing Semiconductive Materials (transistor)
2,929,922	1960	Schawlow, Arthur & Townes, Charles H.	Maser and maser communication system (laser)

for a hay stacker issued to Issac Condra of Seymour, Iowa, a distant relative on my mother's side of the family. Have any of your ancestors been granted a patent?

Patents are fun to use and a great source of ideas for science teaching--try them!

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Note: I wish to express my appreciation for the cheerful assistance given in the preparation of this article by the librarians of the Government Documents Section of D. H. Hill Library at North Carolina State University.